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B7C DH RE

(56) Documents cited
GB 1526883 GB A 2123360

(58) Field of search
B7C

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(54) Reinforcing tyre beads

(57) An encasing member (9; 14/15; 22;25), in the form of a channel-like hoop, having a co-operating pair of rigid limbs (11, 12) extending in the direction of the sidewall, is engaged around at least part of the bead to grip said part. The encasing member (9) may be inside (Figs. 3, 4) or on the outside (Figs. 1, 2) of the bead and is preferably fitted by a high energy e.g. electromagnetic forming force.

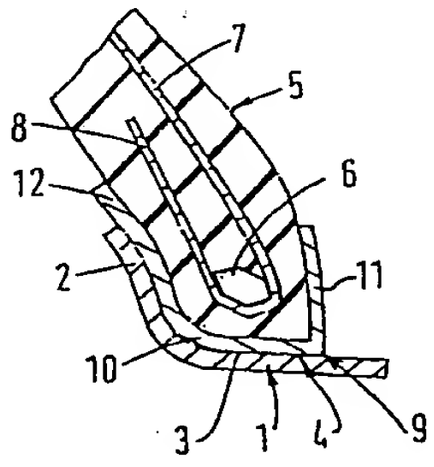

FIG.1

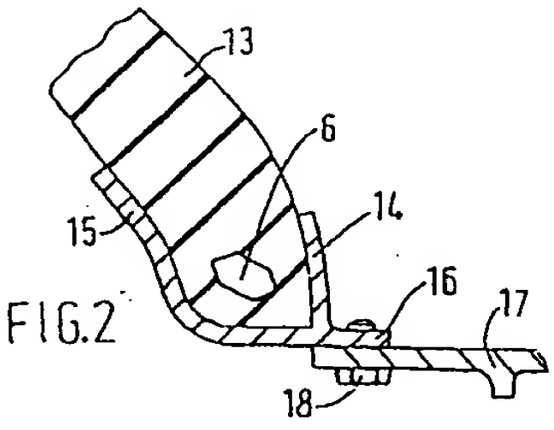

FIG.2

PATENTS ACT 1977

SPECIFICATION NO. 2135253A

The following corrections were allowed under Section 117 on 3 November 1986.

Front page Heading (72) Inventors
for Karl Gebart read Karl Gebert
below Ian Kemp insert Hans Werner Kopp

THE PATENT OFFICE
12 November 1986

CORRECTION

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The encasing member (25, Fig. 4) may replace the conventional bead core, being gripped around a short folded region (27) of the carcass ply. The encasing member may be of constant cross-section or the sides may have cut-outs or a wavy shape.

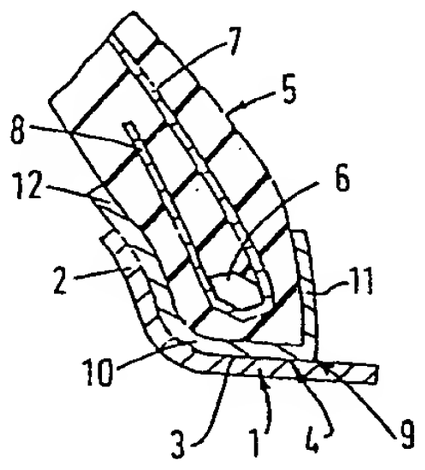

FIG.1

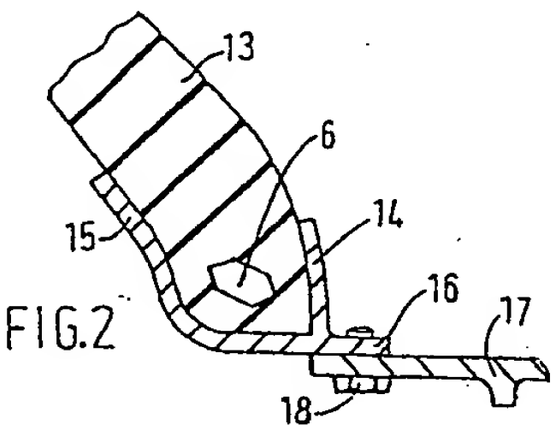

FIG.2

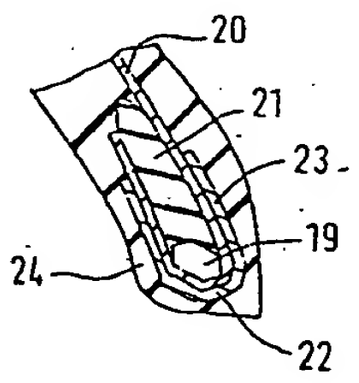

FIG.3

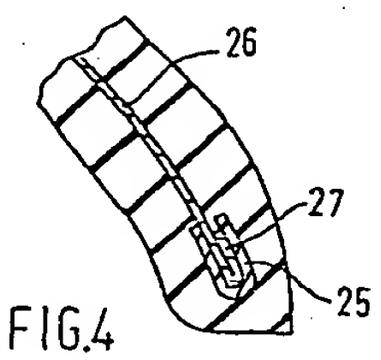

FIG.4

SPECIFICATION AMENDED - SEE ATTACHED SLIP

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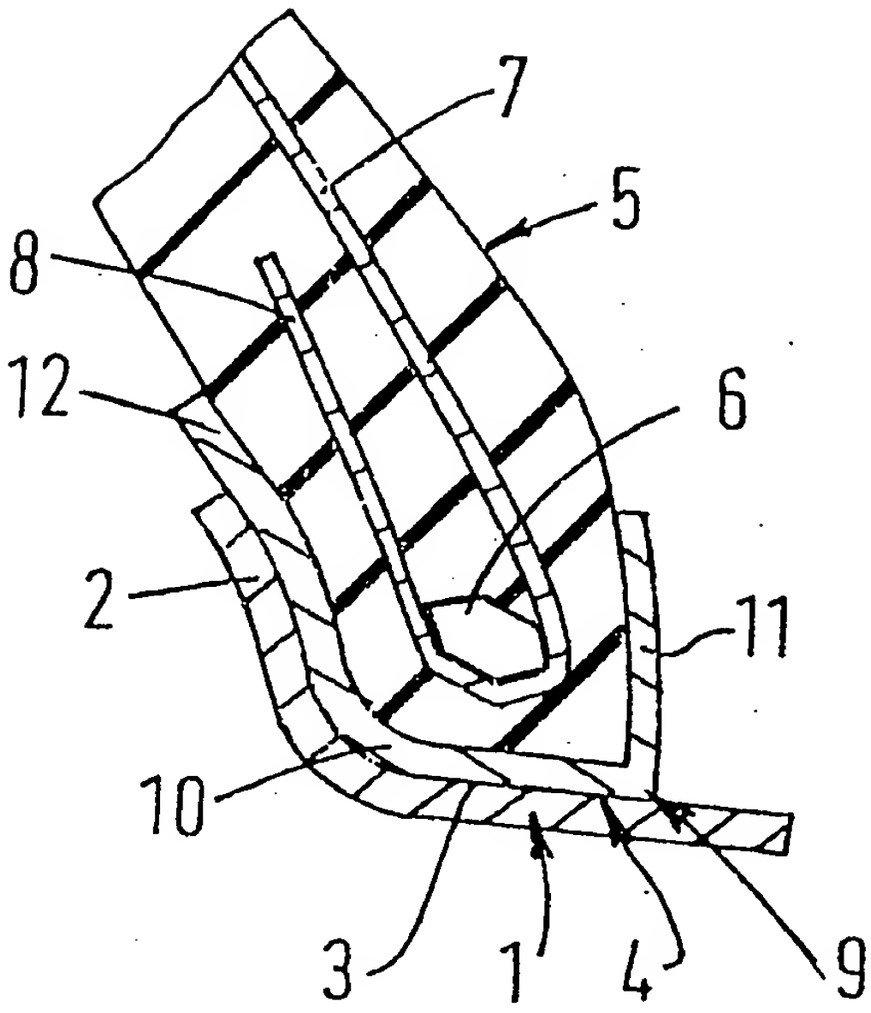

FIG.1

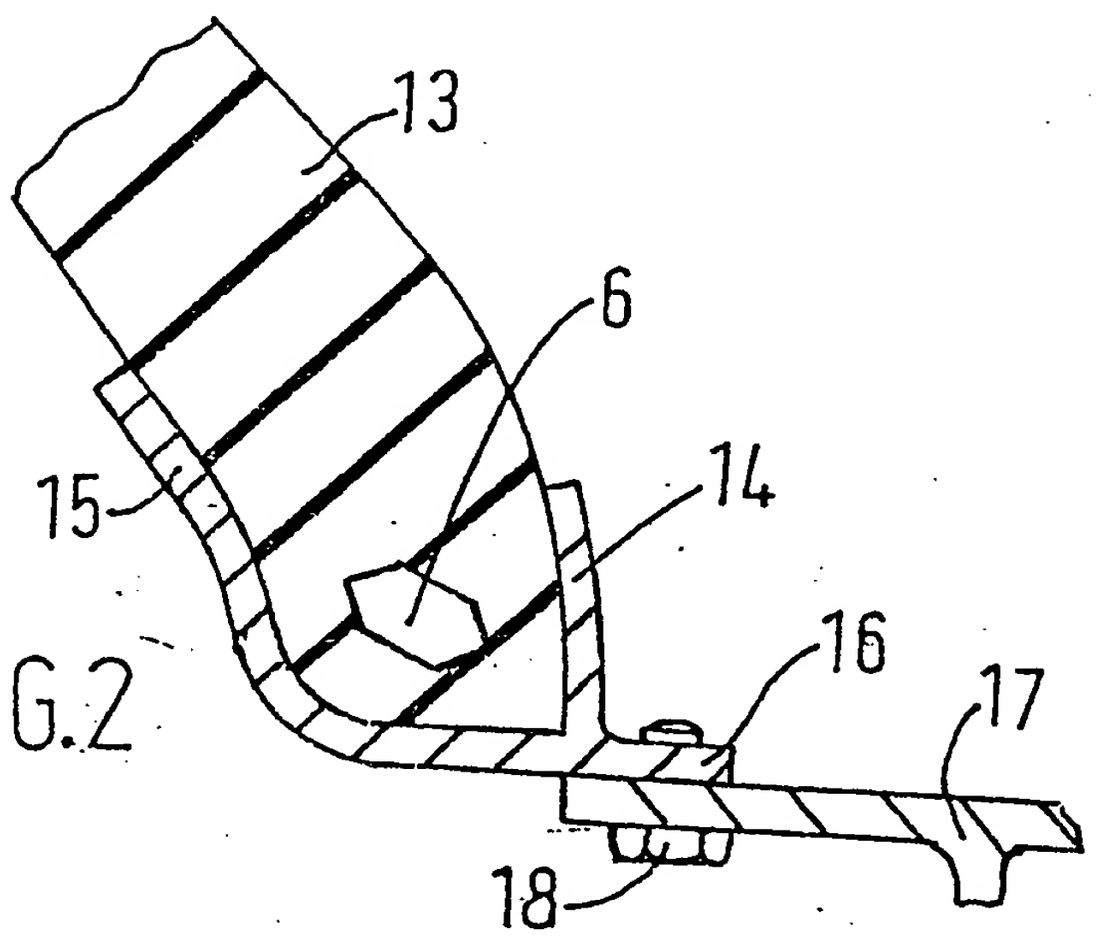

FIG.2

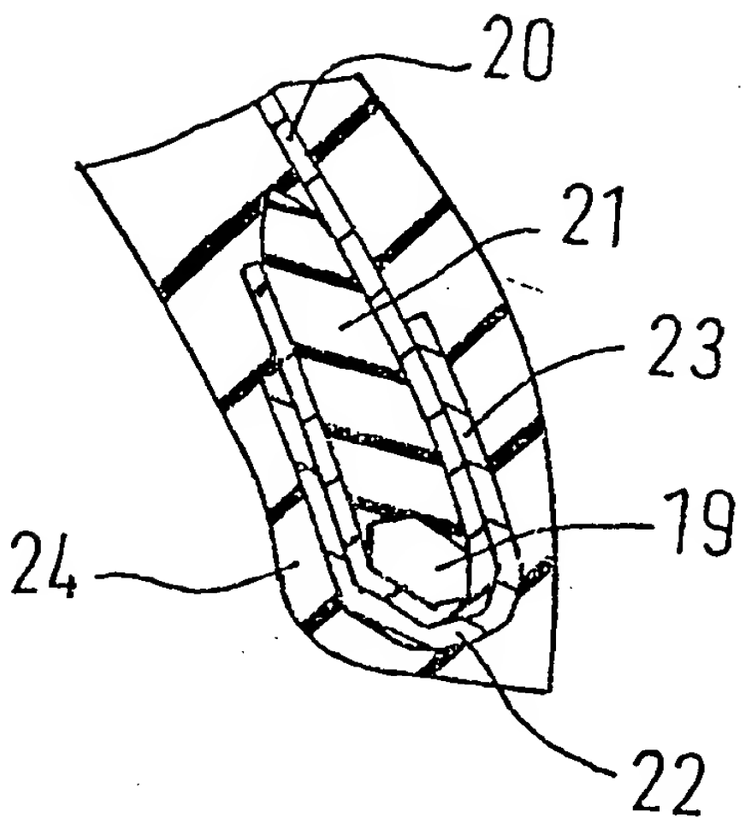

FIG.3

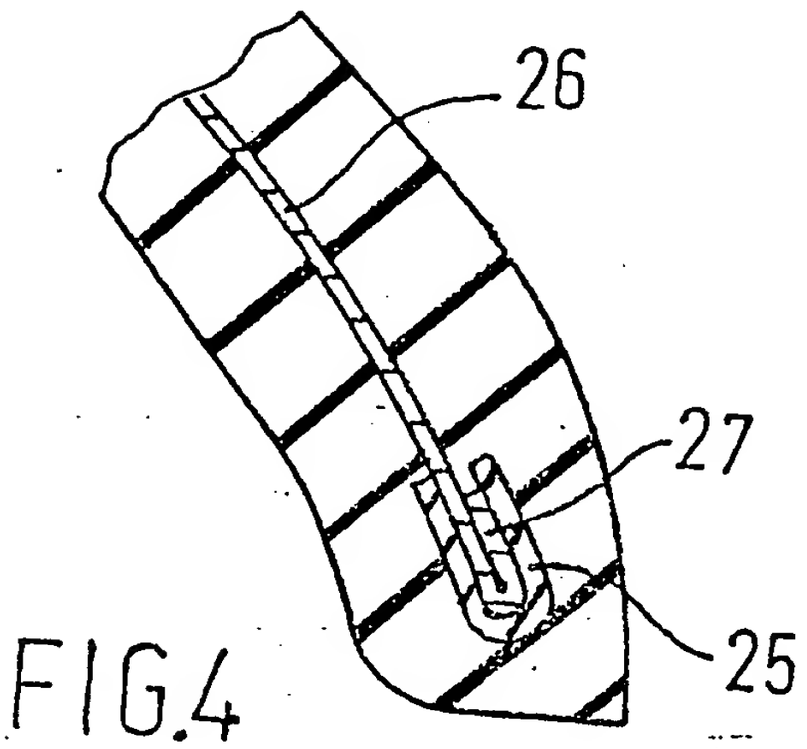

FIG.4

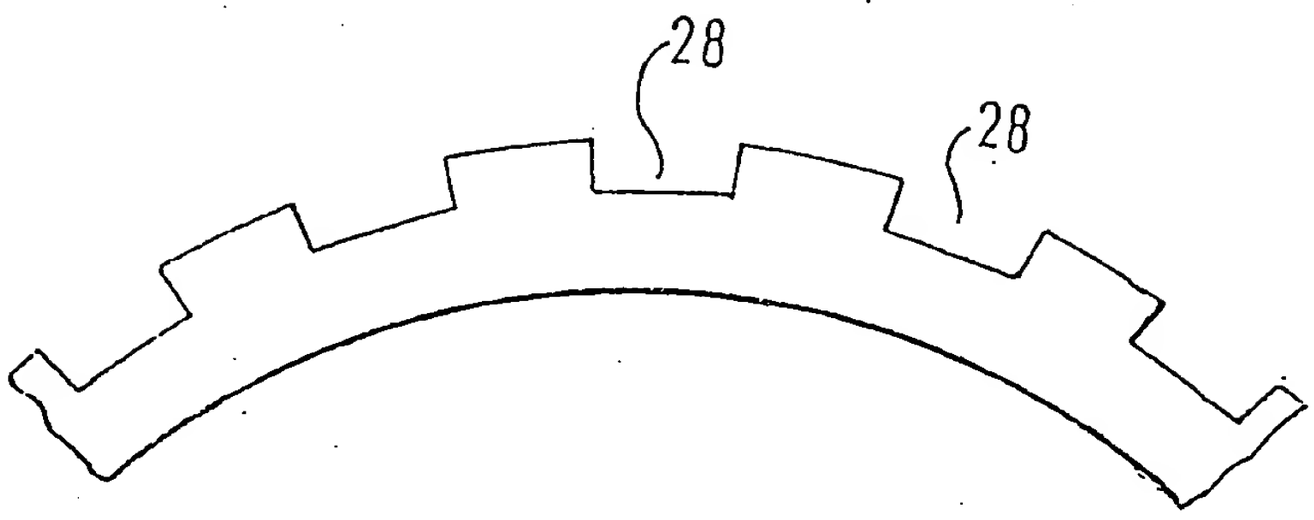

FIG.5

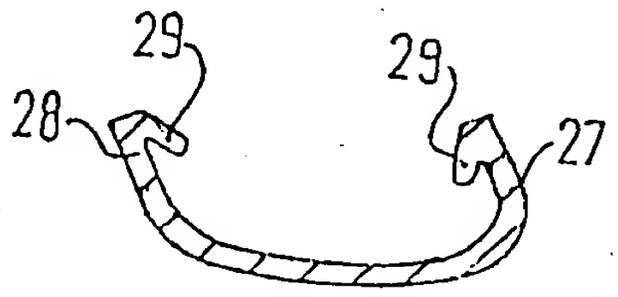

FIG.6

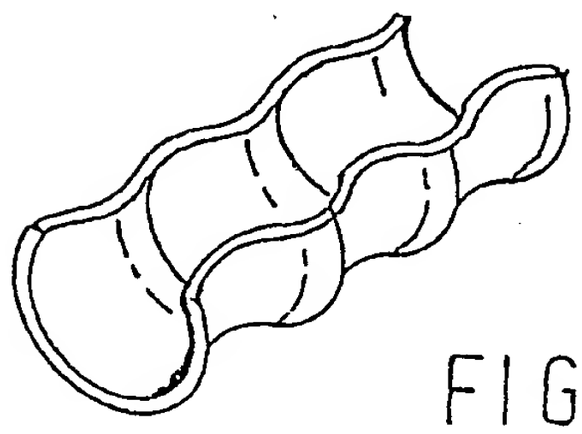

FIG.7

SPECIFICATION

Impr vements to tyres

This invention relates to tyres and in particular to the bead regions of tyres.

A tyre bead provides a termination for the flexible sidewall of a tyre which serves to anchor the reinforcement structure of the tyre carcass and to mechanically link the tyre to its associated wheel rim. The mechanical link needs to be sufficient to retain the tyre in place against driving and braking forces and against side forces generated in use of the vehicle. In tubeless tyres the mechanical link also must be air-tight to retain the air pressure within the tyre.

Tyre beads need to be very carefully designed to provide the above requirements together with fitting and stripping abilities, the essential long life of the link without loss of properties and a junction or end to the carcass reinforcement which has a satisfactory fatigue life and avoids failure of the reinforcement.

One object of the present invention is to provide means for improving the effectiveness of tyre bead design particularly, but not exclusively, for heavy vehicle tyres.

One aspect of the present invention provides a tyre comprising a tread region and two sidewalls each terminating in a tyre bead region including as an integral part of said bead region an encasing member having a co-operating pair of substantially rigid limbs each limb extending in the direction of the sidewall and the limbs being engaged around at least part of the bead region so as to grip said part and reinforce the structure of the bead region.

The encasing member may be at the outside of the bead profile when considered in cross-section so that the encasing member defines the bead shape in at least the lower portions of the bead. Alternatively the encasing member may be within the cross-section of the bead and engage around only a part of the bead structure. In either case, however, the encasing member is in gripping engagement with a component or several components of the bead structure.

The tyre bead may be without a conventional annular bead core in which case the encasing member may engage and grip an edge of the sidewall reinforcement which reinforcement may be folded or wrapped so as to provide increased purchase or engagement for said encasing member. An additional strip of fabric, or elastomer or other material, may also be incorporated within the fold or wrap of the reinforcement.

The tyre bead may incorporate an annular bead reinforcement hoop of any of the known types in the art and the encasing member then may be positioned on the outside of the bead or immediately around and adjacent to the ply or plies where they are wrapped about the bead hoop so as to improve the s curity of the assembly of reinforcement and bead hoop. The encasing member limbs pref rably extend in the direction of the sidewalls beyond the bead hoop and the limbs may close around the bead hoop and/or around at least part of a bead apex strip.

Th encasing member may be in the form of a constant cross-section channel-like hoop or may have a varying cross-section around the circumferential direction. The variation may be purely in shape, for example, the walls of the channel may be sinusoidal in shape in the circumferential direction or may include at intervals a cross-sectional charge in the form of a groove, or the variation may be in thickness of material. Alternatively, the channel may be discontinuous in the circumferential direction having for example radially extending cut-outs formed in its limbs. Indeed for the case where a bead hoop is utilised the encasing member need not have any portion continuous in the circumferential direction but could comprise a series of spaced apart clip members each of which separately engages a portion of the bead. The chosen structure is determined by the degree of extensibility and flexibility required in the tyre bead for use of the tyre and in particular to allow for effective fitting to a wheel rim.

The encasing member may be of any material which is sufficiently rigid to retain a shape impressed upon it so as to grip the components around which it is fixed. Metals are particularly useful and in particular, to allow use of one preferred method of assembly, metals which can be electromagnetically formed are utilised.

The encasing member may be formed with secondary limbs or barbs extending from the limbs. These may extend radially inwards of the tyre so as to effect a more secure retention of tyre components such as sidewall reinforcement fabric.

The encasing member may include an attachment flange which projects from the bead and may be used to attach the tyre bead to a wheel for use on a vehicle. The flange may provide the whole attachment to the wheel or provide only part of the attachment and may engage the wheel continuously or only in certain extreme conditions of use of the tyre/wheel assembly, e.g. when deflate.

Another aspect of the present invention provides a means of engaging an encasing member around a part of a tyre bead assembly comprising positioning an enclosing member, having its pair of limbs in an open or non-engaging position, adjacent to a part of a tyre bead, applying a high energy forming force, as defined herein, to at least the limbs so as to shape the encasing member so that said limbs closely fit the part of the bead with the limbs engaged around said part.

By a high energy forming force is meant a substantial force of very short duration sufficient to cause the material of the encasing member to flow rapidly around the part of the bead being engaged. Such high energy forming techniques include, for example, explosive forming and spark discharge forming both of which utilise a fluid medium to transmit the shock force to the article being shaped but a preferred method is electromagnetic forming. In the latter m thod the encasing member must be of metal which is d formabl by the forces generated by electromagnetism. The method utilises an electromagnetic coil or series of electromagnet coils sometimes including metal pole pieces to which a short pulse of electrical energy is supplied. The pulse

length and shape is closely controlled to provide very accurate control of the force pattern used for the shaping operation and very high energies are obtained by the use of capacitor storage for the electrical energy. This method may be used to fit one bead of the tyre with its encasing member at a time or both beads may be so fitted at the same time.

Further aspects of the present invention will be made apparent from the following description, by way of example only, of some the embodiments of the present invention in conjunction with the attached diagrammatic drawings in which:

Figure 1 is a cross-section of a single tyre bead and associated portion of the wheel rim;

Figure 2 is the cross-section of an alternative tyre bead and wheel rim construction;

Figures 3 and *4* show two further tyre bead constructions;

Figure 5 is a side view of a portion of an encasing member having a modified shape;

Figure 6 is a cross-sectional view of yet another encasing member; and

Figure 7 shows a perspective view of a portion of an encasing member which includes a varying cross-section.

The embodiment shown in Figure 1 comprises a wheel rim 1 having a flange portion 2 and a bead seat portion 3. The remainder of the wheel rim is not shown but is quite conventional in that it has a fitting to allow the tyre to be fitted to the wheel rim. A shallow groove 4 is provided in the bead seat region 3 and includes a rubber sealing ring.

The tyre bead construction comprises a conventional tyre bead 5 having in this case a hexagonal bead core 6, a tyre carcass reinforcing ply 7 which is wrapped around the bead core 6 and extends as shown to come back to the main carcass ply where it terminates at a point 8.

The tyre bead also includes as an integral part of the bead an encasing member 9 which comprises a steel channel-like member which has a base portion 10 and a pair of limbs 11 and 12 which extend generally in the direction of the sidewall of the tyre. The limbs 11 and 12 are engaged tightly around the remainder of the construction of the tyre bead and are therefore mechanically locked on to the bead. The channel encasing member 9 is of constant cross-section around the tyre bead and is in the form of an endless channel shaped hoop. The resultant construction is one where the tyre bead includes a metal surface portion provided by the encasing member which provides the seating of the tyre bead on the wheel rim 1.

The construction show in Figure 2 comprises a tyre bead 13 which is a conventional tyre bead again including a bead core 6 and reinforcem nt (not shown). Once again, a channel-like encasing member is provided which is integral with the tyre bead which has inner and outer limbs 14 and 15 which are in close fitting mechanical engagement with the tyre bead 13. The encasing member also includes an axially inwardly projection mounting lug 16. The tyre bead of this embodiment does not require a conventional wheel but a simplified wheel rim is shown to which the mounting lug 16 is attached by a series of bolts, one of which is shown 18. Sealing means are provided as necessary of the tyre is a tubeless tyre. The above embodiments generally illustrate constructions in which the limbs of the encasing member are on the outside of the tyre bead. The embodiments of Figure 3 and 4 utilise the encasing member within the tyre bead so that the tyre bead has in fact a visual appearance of a normal tyre bead. The tyre bead in Figure 3 comprises a conventional hexagonal bead core 19, a reinforcing ply 20 and an apex strip 21 around which the reinforcing ply 20 is wrapped. The encasing member 22 is fitted immediately over the wrapped reinforcing ply 20 and limbs 23 and 24 of the encasing member 22 are closed around the reinforcing ply so as to grip it to the bead wire and apex strip and retain the reinforcing ply within the assembled bead. The remainder of the bead components are then assembled around the encasing member 22 and the bead completed. The resultant tyre bead however, in including the encasing member 22 exhibits an improved degree of fixing of the reinforcing ply 20.

The embodiment of Figure 4 uses an encasing member 25 in place of a bead core. The reinforcing ply 26 is folded back on itself in a short folded region 27 and then the encasing member 25 is engaged around the folded portion 27 so as to grip it. The encasing member 25 in being a continuous U-channel section provides the necessary reinforcing hoop for the tyre to be seatable on a bead set in the conventional manner. The remainder of the tyre bead is assembled around the ply and encasing member. Thus, this assembly is one in which no reinforcement hoop is used. Clearly various folds can be used to terminate the reinforcing ply and if necessary a small bead core can be used which need not have any tensile strength and should be material other than the conventional steel wire.

The encasing member shown in Figure 5 is not of constant cross-section but has cut-outs 28 in each of the limbs. This provides increased flexibility for the channel shaped encasing member. The encasing member shown in Figure 6 has a pair of outstanding limbs 27 and 28 each of which include supplementary barbs 29 which are deformed so as to engage the tyre bead. Such bards can be used to further increase the mechanical lock of the encasing member to the tyre bead and are particularly useful when the encasing member is applied immediately over the tyre reinforcing ply.

The channel section open in Figure 7 has each of the sides waved so as to have a sinusoidal shape as shown. The effect of this is to give a channel section which is comparatively flexible and this may assist in fitting the tyre to the wheel rim in some circumstances.

Clearly many variations are possible using channel shap d members in mechanical engagement with parts of the tyre bead. Similarly many bead constructions can be used with varying numbers of plies and different components in the tyre bead as well as different bead cross-sections. The above examples are purely to illustrate some of the examples of the present invention.

The encasing members are preferably attached to

the tyre or the part of the tyre if there are internal encasing members by means of magnetic forming. The encasing member is first of all made with its limbs in an open position so that they may be fitted to the tyre bead and then a very strong magnetic field is applied to the metal of the encasing member as a very short pulse of energy. The result is that the encasing member limbs are plastically deformed and flow so as to engate the part of the tyre bead as required. The advantage of this particular forming method is that the engagement of the encasing member is extremely close to the parts of the bead even though the bead parts are of elastomer and deformation of the elastomeric parts does not occur. The limbs of the encasing member may in fact be in a flat position prior to forming and the U-shape is only formed when the electrmagnetic force is applied.

Careful design of the electromagnetic machine and careful control of the power applied enables the tyre beads having consistent constructions to be obtained which include encasing members which are formed from very simple initial components.

CLAIMS

1. A tyre comprising a tread region and two sidewalls each terminating in a tyre bead region including as an integral part of said bead region an encasing member having a co-operating pair of substantially rigid limbs each limb extending in the direction of the sidewall and the limbs being engaged around at least part of the bead region so as to grip said part and reinforce the structure of the bead region.

2. A tyre according to claim 1 wherein the encasing member is at the outside of the bead profile when considered in cross-section so that the encasing member defines the bead shape in at least the lower portions of the bead.

3. A tyre according to claim 1 wherein the encasing member is within the cross-section of the bead and engages around only a part of the bead structure.

4. A tyre according to claims 1, 2 or 3 wherein the encasing member is in gripping engagement with a component or several compnents of the bead structure.

5. A tyre according to any of claims 1 to 4 wherein the tyre bead is without a conventional annular bead core and the encasing member engages and grips an edge of the sidewall reinforcement.

6. A tyre according to claim 5 wherein the reinforcement is folded or wrapped so as to provide increased purchas or engagement for said encasing member.

7. A tyre according to claim 4, 5 or 6 wher in additional strip f fabric, of elastomer or other material, is incorporated within the fold or wrap of the reinforcement.

8. A tyre according to claim 1, 2, 3 or 4 wherein the tyre bead incorporates an annular bead reinforcement hoop of any of the known types in the art and the encasing member is positioned on the outside of the bead or immediately around and adjacent to the ply or plies where they are wrapped about the bead hoop so as to improve the security of the assembly of reinforcement and bead hoop.

9. A tyre according to claim 8 wherein the encasing member limbs extend in the direction of the sidewalls beyond the bead hoop and the limbs are closed around the bead hoop.

10. A tyre according to any one of claims 1 to 9 wherein the encasing member is in the form of a constant cross-section channel-like hoop.

11. A tyre according to any one of claims 1 to 9 wherein the encasing member has a varying cross-section around the circumferential direction of the tyre.

12. A method of engaging an encasing member around a part of a tyre bead assembly comprising positioning an enclosing member, having its pair of limbs in an open or non-engaging position, adjacent to a part of a tyre bead, applying a high energy forming force, as defined herein, to at least the limbs so as to shape the encasing member so that said limbs closely fit the part of the bead with the limbs engaged around said part.

13. A tyre constructed and arranged substantially as described herein and illustrated in any of the attached Figures 1, 2, 3, 4, 5, 6 or 7.

14. A method of engaging an encasing member around a part of a tyre bead assembly substantially as described herein in conjunction with the attached Figures of the accompanying drawings.

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